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Luperti et al.

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[45] **Date of Patent: Feb. 3, 1987**

[54] **REVERSE COLLATING MACHINE**

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[73] Assignee: **Pitney Bowes Inc.**, Stamford, Conn.

[21] Appl. No.: **791,889**

[22] Filed: **Oct. 28, 1985**

[51] **Int. Cl.**[4] **B65H 31/36**

[52] **U.S. Cl.** **271/212**; 271/245; 414/92

[58] **Field of Search** 271/212, 245, 246, 3.1, 271/216, 202, 203, 270; 414/92; 148/462, 423; 83/88

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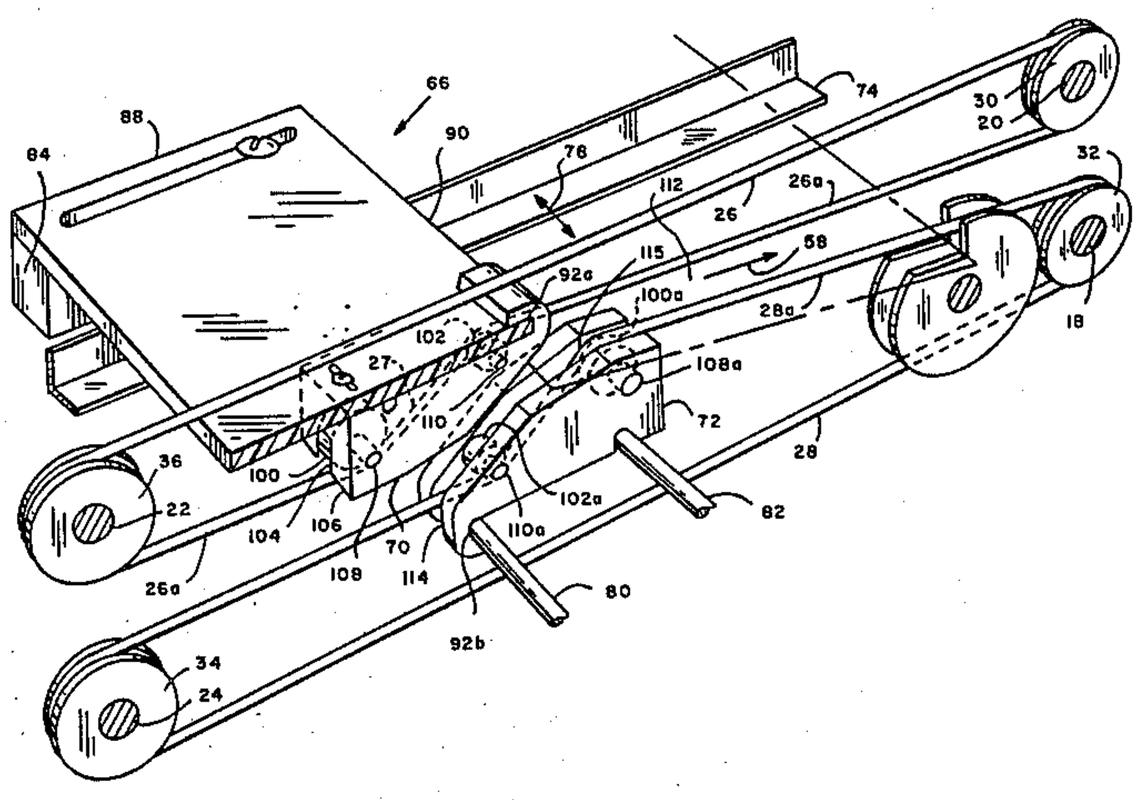
Primary Examiner—D. C. Butler
Assistant Examiner—John A. Carroll
Attorney, Agent, or Firm—Lawrence E. Sklar; Melvin J. Scolnick; David E. Pitchenik

[57] **ABSTRACT**

An improvement in a collating machine for stacking sheets of paper being fed seriatim thereto from a singulating feeder in the same order as the sheets appear in the singulating feeder. The collating machine includes a belt for transporting the sheets of paper, a ramp for lifting a succeeding sheet of paper over and onto a preceding, stopped sheet of paper, and a stopping device for stopping each sheet of paper after the sheet has been lifted by the ramp. The improvement includes a removable stacking device for stacking the sheets of paper in the reverse order as the sheets appear in the singulating feeder.

5 Claims, 12 Drawing Figures



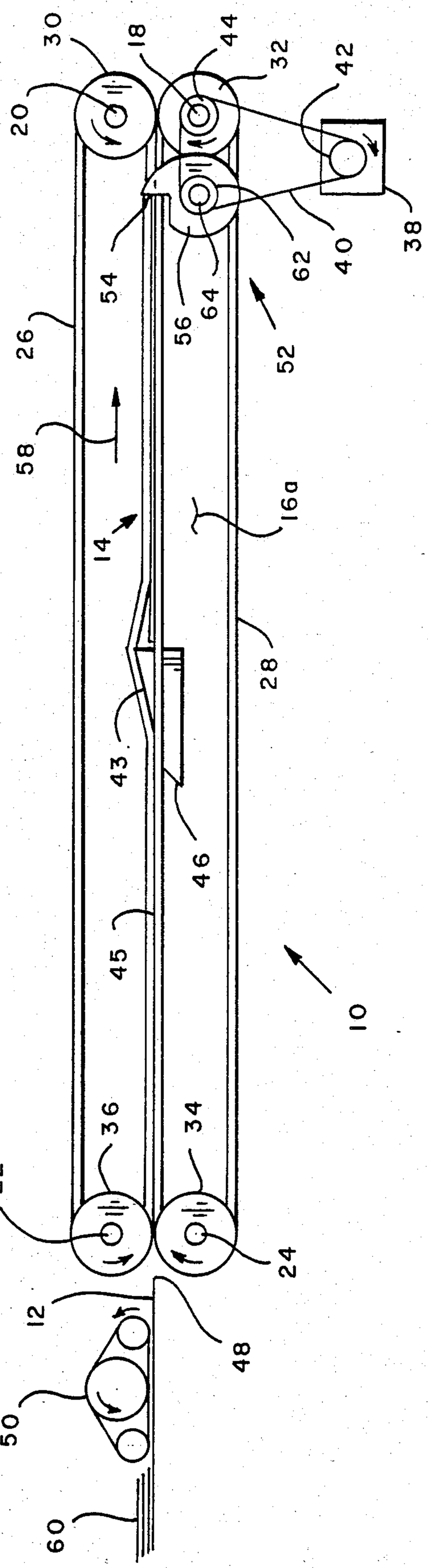


FIG. 1
PRIOR ART

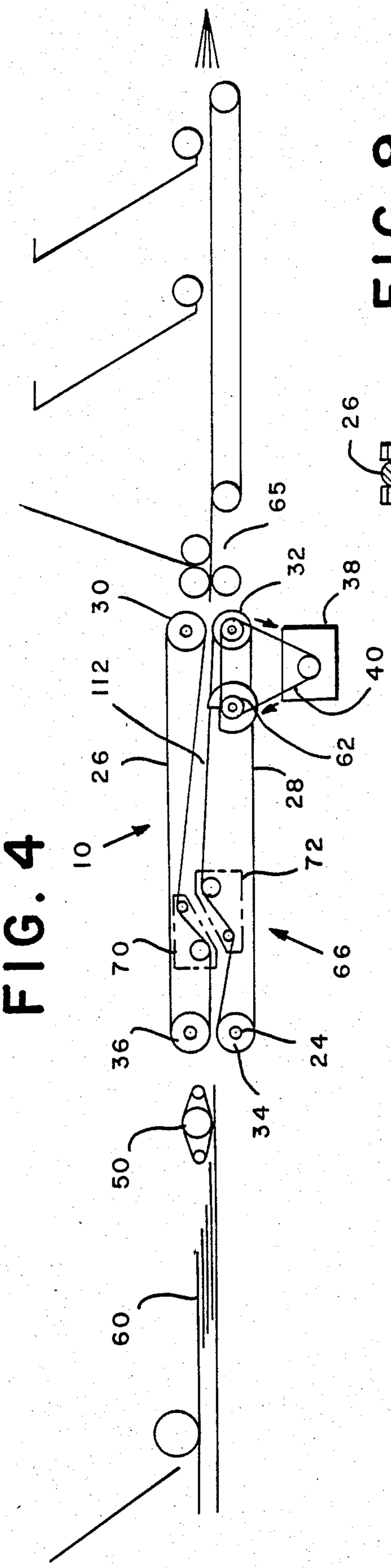


FIG. 4

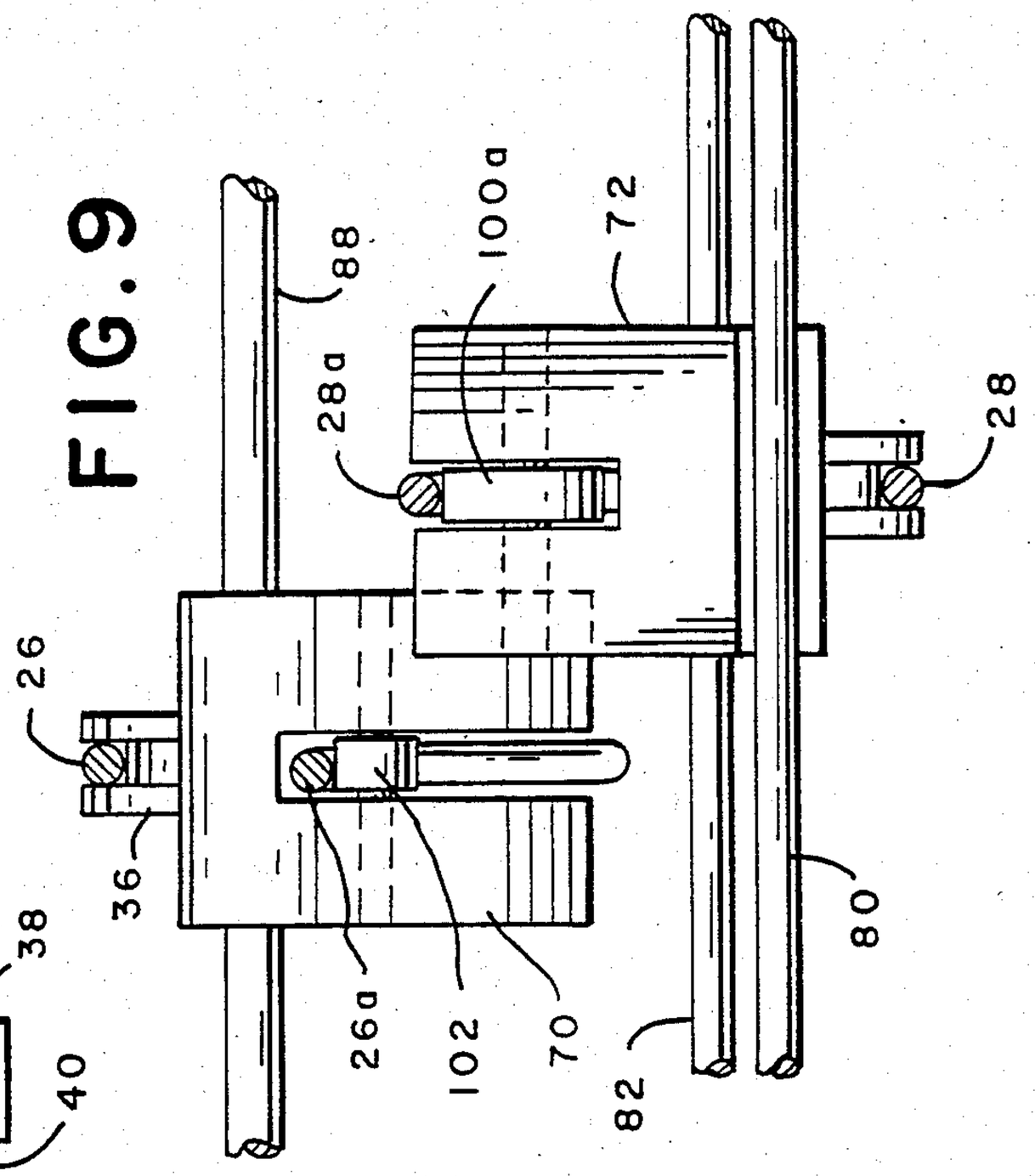


FIG. 6

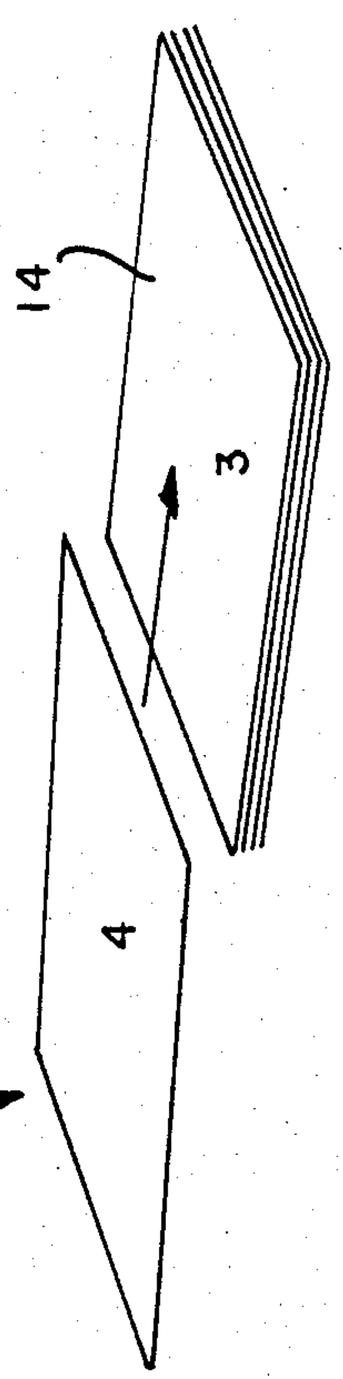


FIG. 2

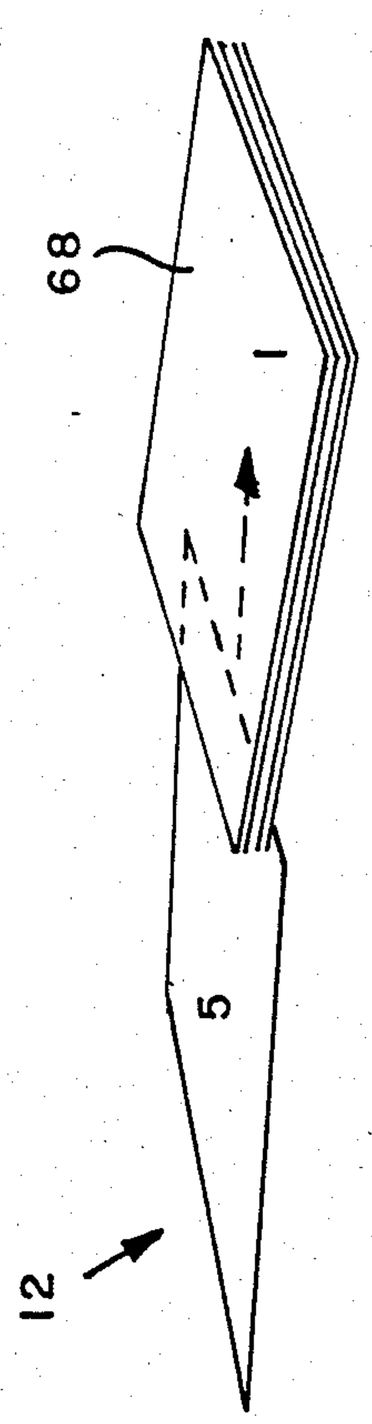
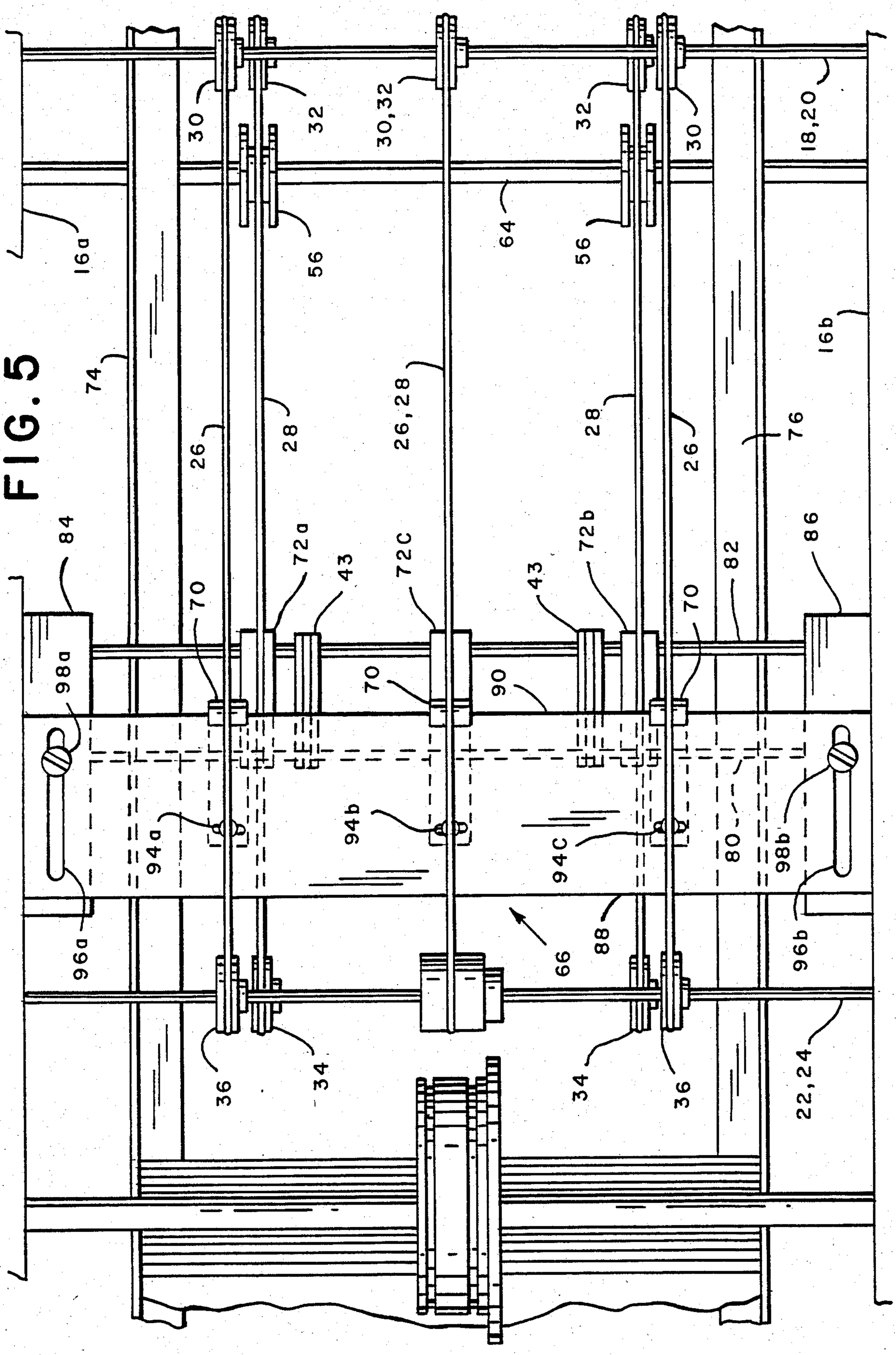


FIG. 3

FIG. 5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32
30,32
32
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18,20
16a
56
64
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74
26
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26,28
72a
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72b
28
26
76
16b
84
70
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94C
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96a
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96b
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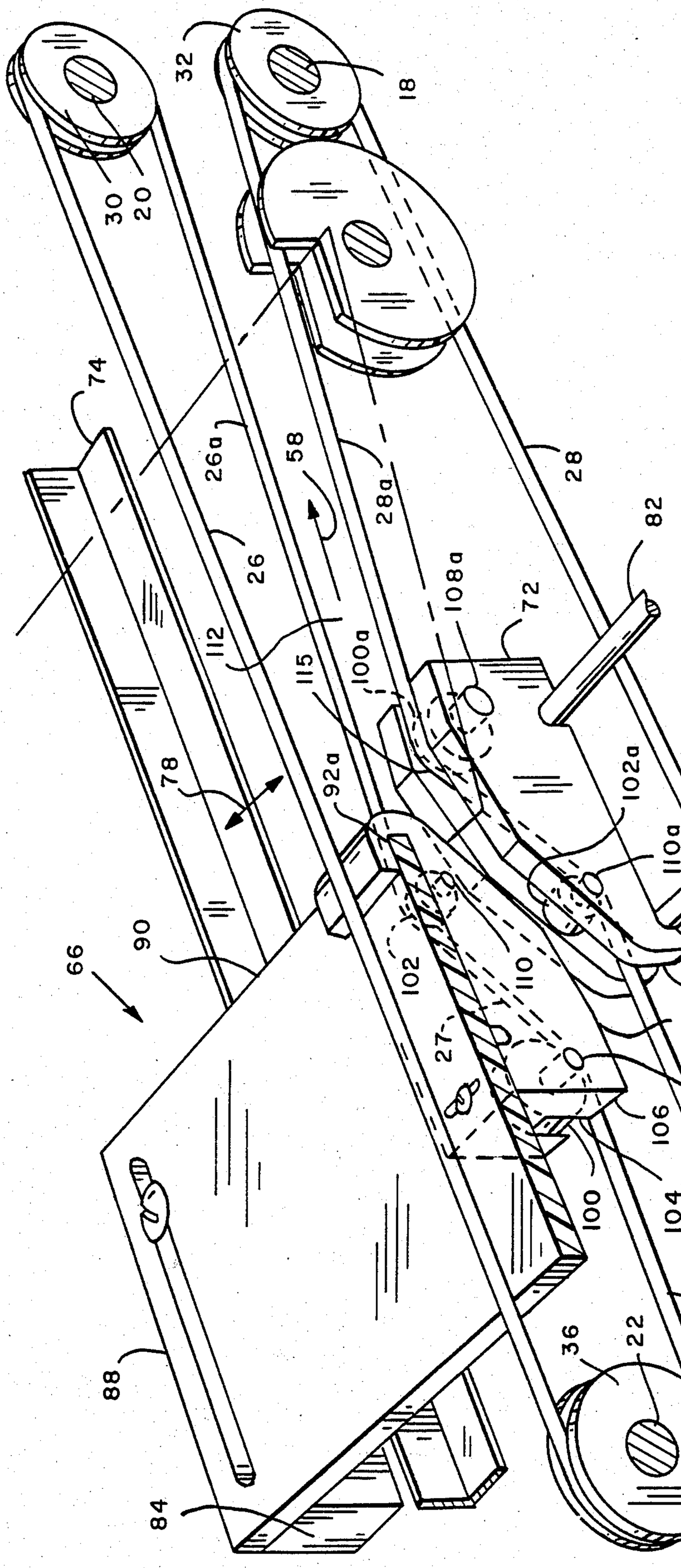
22,24


32
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74
26a
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26
112
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100a
108a
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92a
102a
110a
66
90
102
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92b
114
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104
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84
36
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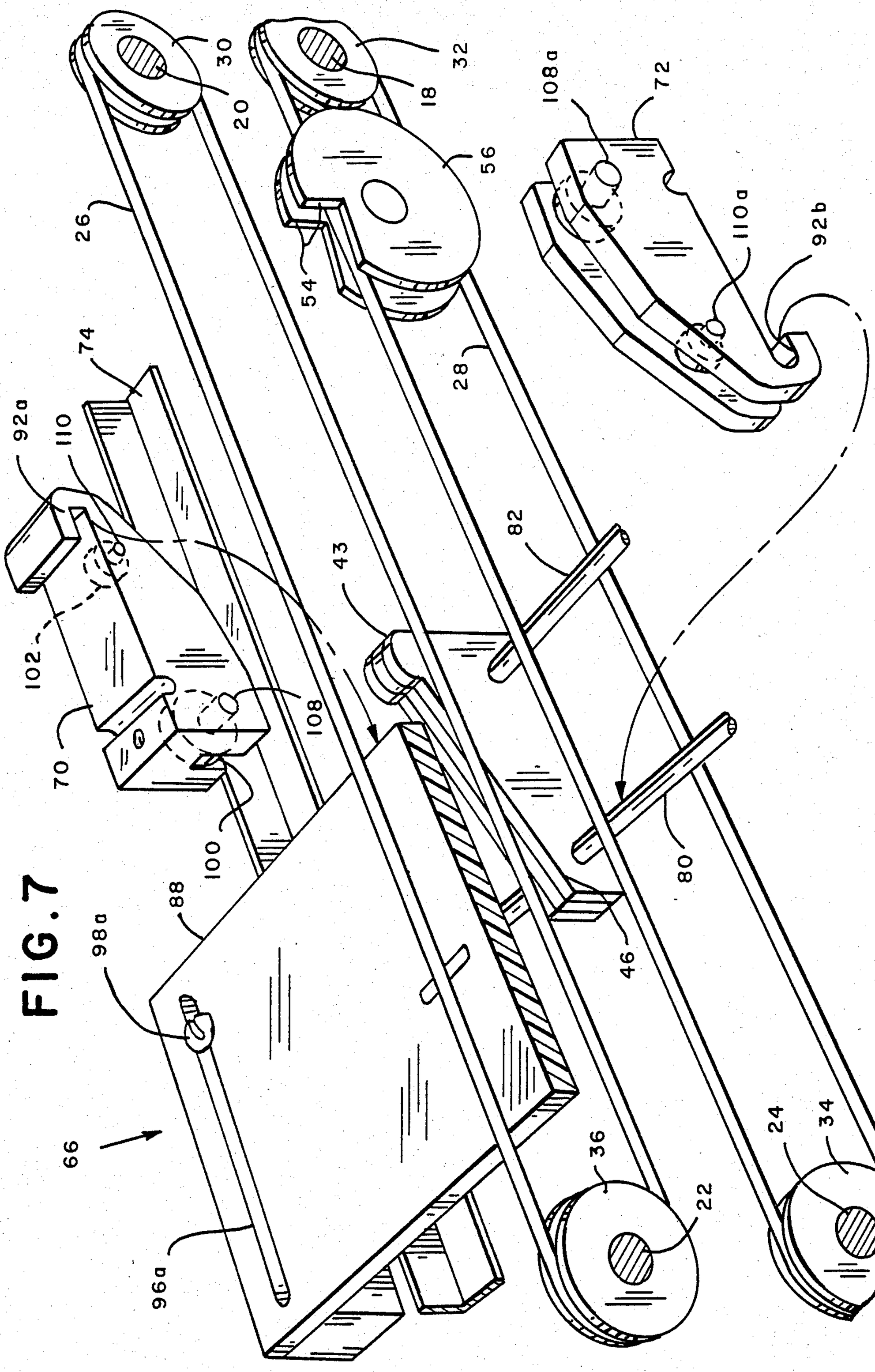
26a
34
24

FIG. 6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96a
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FIG. 7

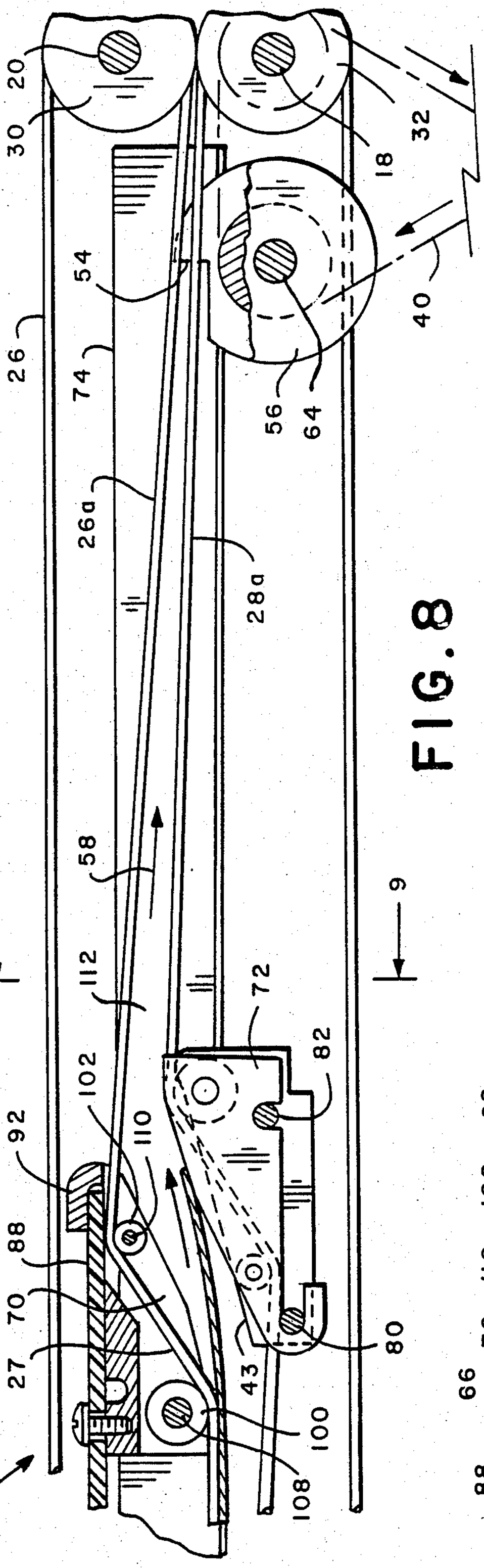
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FIG. 8

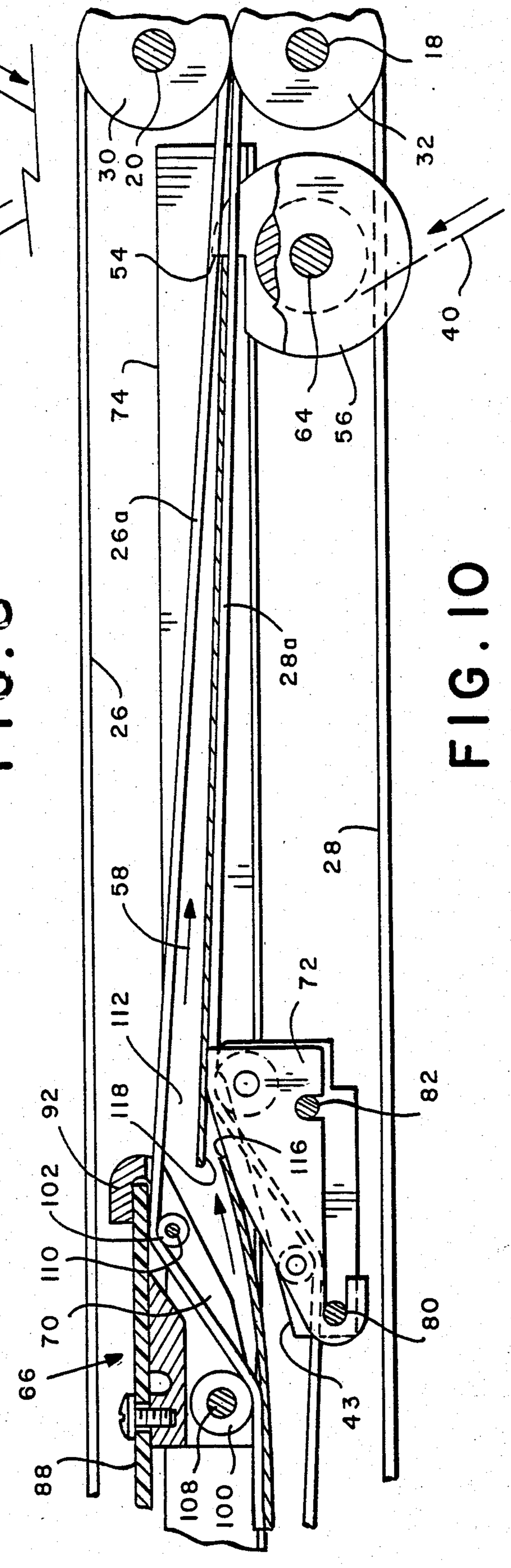
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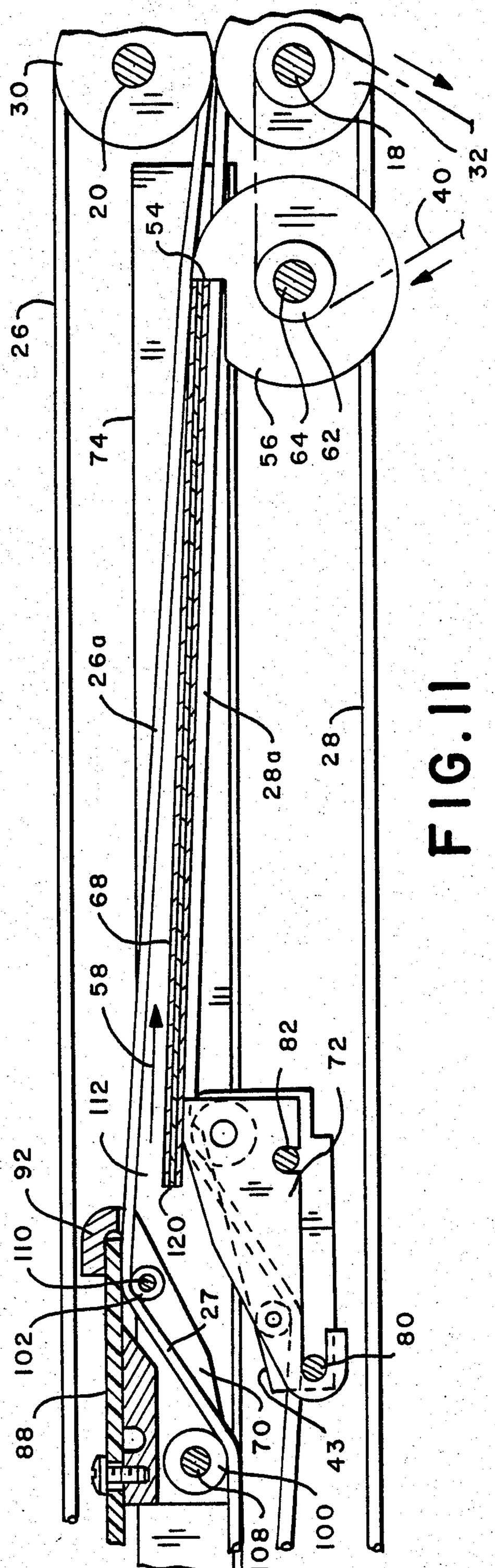
FIG. 10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26a
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120
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102
70
88
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108
100
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FIG. 11

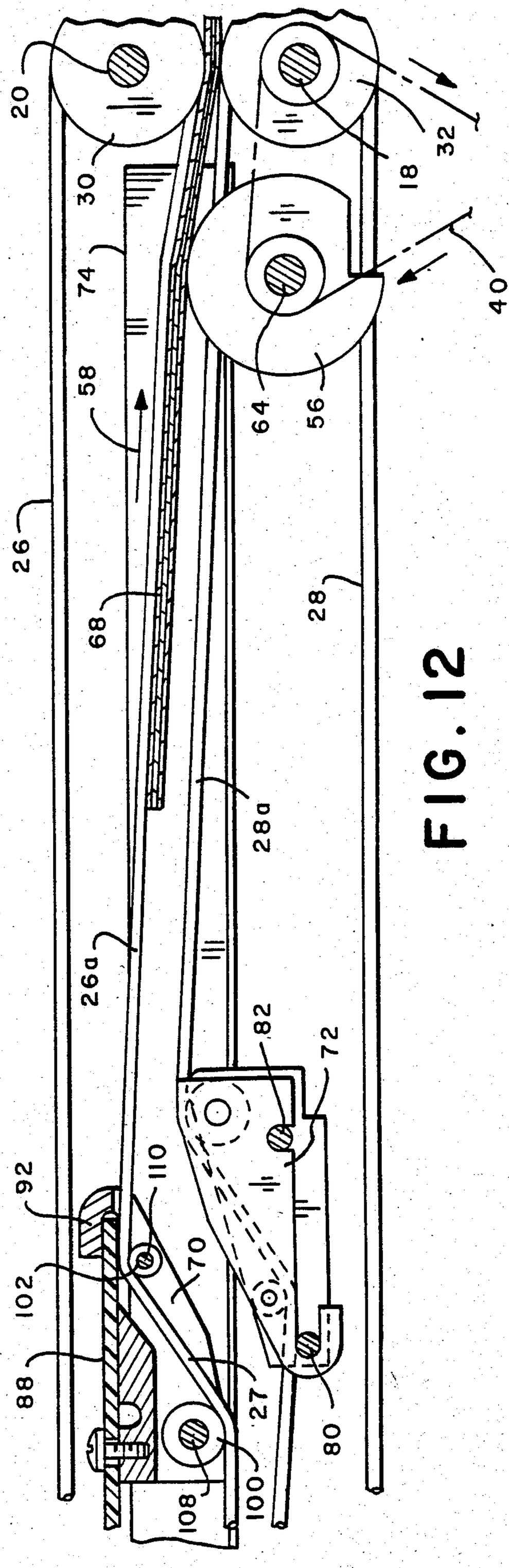
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FIG. 12

REVERSE COLLATING MACHINE

BACKGROUND OF THE INVENTION

The instant invention relates to a collating machine and more particularly to a collating machine having the dual capability of stacking sheets of paper in the same or reverse order in which they are fed to the collating machine.

Collating machines are frequently used in line with other paper handling equipment as a means of assembling a plurality of sheets of paper into a particular, desired packet prior to further processing, which may include additional collating, folding, and inserting. For further background, reference can be made to U.S. Pat. Nos. 2,766,569 and 4,143,981. In a typical paper handling sequence involving an initial output consisting of a plurality of sheets of paper, to be later combined with subsequent output from other feeders downstream, the initial output is fed from a stack seriatim to the collator, which collates the output into the desired packets, either in the same order as the sheets had when they were in the precollator stack or the reverse order. Each packet is then folded and subsequently combined with other output from document feeders located downstream thereof and ultimately inserted into an envelope.

In many cases it happens that the initial output to be collated arrives in an opposite order so that the collator needs to collate in an opposite manner to enable the documents to emerge from the collator in the proper sequence for subsequent handling. In such a case, the only real option is to have a second line of paper handling equipment which includes a collator having reverse collating capability. Clearly, this is not a desirable option to users of paper handling equipment.

Accordingly, the instant invention provides an improvement in a collating machine permitting the same collating machine to be used for collating in the same or reverse order as the documents are fed to the collator. Changing the collating order of the machine requires only a few minutes of an operator's time to add or remove a few parts and is easily accomplished with the instant invention.

Summary of the Invention

In accordance with the foregoing, the instant invention provides an improvement in a collating machine for stacking sheets of paper being fed seriatim thereto from a singulating feeder in the same order as the sheets appear in the singulating feeder. The collating machine includes belt means for transporting the sheets of paper, ramp means for lifting a succeeding sheet of paper over and onto a preceding, stopped sheet of paper, and means for stopping each sheet of paper after the sheet has been lifted by the ramp means. The improvement comprises removable means for stacking the sheets of paper in the reverse order as said sheets appear in the singulating feeder.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a side elevational view of a prior art, inline collating machine;

FIG. **2** is a perspective view showing a stack of paper sheets being collated in order;

FIG. **3** is the same as FIG. **2** except that the stack of paper sheets is being collated in reverse order;

FIG. **4** is a side, elevational view of an in-line collating machine in accordance with the instant invention;

FIG. **5** is a top, plan view of the collating machine seen in FIG. **4**;

FIG. **6** is a perspective view, broken away, of the collating machine seen in FIG. **5**;

FIG. **7** is the same as FIG. **6** except it shows an upper and a lower ramp guide block removed from the collating machine;

FIG. **8** is a side, elevational view of the collating machine seen in FIG. **5** showing a first sheet of paper being fed between the ramp guide blocks;

FIG. **9** is a sectional view taken on the plane indicated by the line **9—9** in FIG. **8**;

FIG. **10** is the same as FIG. **8** except that the first sheet of paper has been stopped and a second sheet of paper is being fed between the ramp guide blocks and under the first sheet of paper;

FIG. **11** is the same as FIG. **10** except that three sheets of paper have now been stopped and collated into a registered stack;

FIG. **12** is the same as FIG. **11** except that the registered stack is seen being fed out from the collating machine preparatory to further processing.

DETAILED DESCRIPTION

In describing the preferred embodiment of the instant invention, reference is made to the drawings wherein a typical collating arrangement featuring a collating machine **10** as seen in FIG. **1**. The collating machine **10** is schematically illustrated for accumulating a plurality of sheets **12** in order as shown in FIG. **2**, that is, in FIG. **2** a stack **14** of sheets **12** is arranged so that the first sheet **12** is deposited first, i.e., the first sheet **12** is positioned on the bottom of the stack **14**. This is accomplished by means of a suitable, cooperating, conveying apparatus within the collating machine **10**. The conveying apparatus is formed between frames (not shown) which suspend a pair of driven shafts (see FIG. **1**) **18** and **20** and a pair of idler shafts **22** and **24**. There is a plurality of suitable, elastic conveyor belts **26** and **28** which are suspended over suitable pulleys **30, 32, 34** and **36** all of which are operatively connected to their respective shafts. There is an AC motor **38**, which is provided with a drive member **40**, which is in turn appropriately engaged with pulleys **42** and **44**, in turn which are operatively connected to their respective shafts.

A plurality of sheet elevating ramps **43** are rigidly suspended and interposed between the belts **26** and **28** along a conveying path **45** for the sheets **12** so that a lower end **46** of a ramp **43** typically intercepts a leading end **48** of the sheets **12** as they are individually conveyed along path **45**, having been separated by an upstream singulating feeder **50**. When the sheets **12** reach the ramp **43**, they are slightly elevated so that each sheet **12** will deposit upon the preceding sheet **12** which is registered at a cyclable registration device **52**. The sheets **12** accumulate between the cooperating surfaces of the belts **26** and **28**, and stop against a vertical surface **54** formed on plurality of disks **56** which are laterally interposed between the belts **26** and **28**. The leading edge **48** of each sheet **12** therefore remains in contact with the surfaces **54** of the disks **56** since the belts **26** and **28** continue to urge the stack of sheets **14** in a downstream direction **58**. It will be noted that the stack of sheets **14** is in the same order in which they were separated at the singulating feeder **50**, since the feeder **50** advances the sheets **12** one at a time from the bottom of

a supply stack **60** which is continuously shingled as shown in FIG. **1**.

When the collating machine **10** has accumulated the required number of sheets **12** in the registered position at the cyclable registration device **52**, a predetermined electronic control device (not shown) provides power to a 24 volt D.C. electromagnetic clutch device **62**, which then rotatably engages a shaft **64** having the disks **56** suspended and mounted coaxially therewith. The clutch device **62** is rotatably coupled to the drive member **40**, and the stack of sheets **14** is then advanced along the path **45** in the downstream direction **58** to, for example, a folding machine **65** (see FIG. **4**). Subsequent operations are then provided to the stack of sheets **14**, such as folding, as previously discussed.

Referring to FIG. **4**, there is shown the same collating machine **10** as previously described, with the exception that a sheet ramp apparatus **66** has been added. It is pointed out that the sheet elevating ramps **43** of the preceding described machine remain in place. It will become evident that the apparatus **66** is such that it is easily installed in the machine **10** by an operator who requires that the sheets **12** be accumulated into a stack **68** as shown in FIG. **3**, i.e., that the sheets **12** are to be stacked in reverse order from which they were separated by the feeder **50**.

Referring now to FIG. **4**, there is seen the same collating machine **10**, which utilizes the belts **26** and **28**, and the same suspension, drive and framework previously described. There is a first removable ramp guide block **70**, and a second removable ramp guide block **72** which are each provided in a set of three as seen in FIG. **5**. The first blocks **70** are equally separated and disposed between a sheet edge guide **74** and **76**, and are located to cooperate with the belts **26** and **28** as will be described in more detail hereinbelow.

Referring to FIG. **6**, the construction of the belts **26** and **28** are seen to be of an "O" ring nature. However, it is possible to utilize a flat belt, as long as the belt material is elastic, or there is provided an adequate belt tensioning system, the likes of which are well known by those skilled in the art.

The sheet ramp apparatus **66** is generally installed into the machine **10** by utilization of a few structural parts which suspend the blocks **70** and **72** in a predetermined position in the direction **58**, as well as in a lateral direction **78**. The frames **16***a* and **16***b* are used to mount suitable bearings for all of the rotating, or rotatable shafts previously described, and there are a number of fixed, elongated members which are used to locate and fasten the sheet ramp apparatus **66**. For example (see FIG. **5**), there is a rod **80** and a rod **82** which span the frames **16***a* and **16***b* and are located in holes in spacer blocks **84** and **86**, which in turn are appropriately secured to the inside surface of the frame **16***a* and **16***b*. There is a generally flat, rectangular, plastic member **88** which is used to anchor the first ramp guide blocks **70** in a generally horizontal direction. An edge **90** of the member **88** cooperates with a slot opening **92***a* (see FIG. **6**) on each block **70**, and screws **94***a*, **94***b* and **94***c* clamp the blocks **70** against vertical movement. The plastic member **88** has slots **96***a* and **96***b*, and there are screws **98***a* and **98***b* which clamp the member **88** to the blocks **84** and **86** respectively. The slots **96***a* and **96***b* enable adjustment of the member **88** with the attached blocks **70** in the direction **58** as will be described hereinbelow.

FIG. **6** illustrates the sheet ramp apparatus **66** in detail, and shows the resuspended path of each of the belts **26** and **28** which cause the effect of the invention. The blocks **70** typically have rollers **100** and **102**, each of which is centrally located in a lateral direction in a slot **104** on a bottom side **106**. There are removable pins **108** and **110** for rotatably suspending the rollers **100** and **102** respectively. The pins **108**, **108***a* and **110** and **110***a* are removable to enable an operator to easily install the apparatus **66** as is required. Alternately, removing the pins **108**, **108***a* and **110** and **110***a* allows conversion of the collator **10** to regular order stacking. A lower reach **26***a* of the upper belt **26** has an engaged portion **27** suspended under the roller **100** and over the top side of the roller **102** such that a sheet receiving space **112** exists between an upper reach **28***a* of the belt **28** (see FIGS. **4** and **6**) and the lower reach **26***a* of the belt **26**.

The blocks **72** are arranged laterally to accommodate the belts **26** and **28** which are slightly offset by a small lateral dimension. For example, in FIG. **5**, block **72***a* is positioned slightly inside (towards the center) of the belt **26**, and block **72***b* is positioned slightly inside of the belt **26**. The block **72***c* is aligned directly beneath the block **70** however. Each block **72** has a slot **114** (see FIG. **6**) centrally located within the block **72** in a lateral direction, within which there is a roller **100***a* and **102***a* which are further rotatably mounted on removable pins **108***a* and **110***a* respectively. The upper reach **28***a* of the belt **28** has an engaged portion **115** suspended under the roller **102** and over the roller **100***a*. There is, in effect, a predetermined angle of about 135° between the engaged portions **27** and **115** of the belts **26** and **28** respectively. It will be noted that the engaged portions **27** and **115** of the belts **26** and **28** are spaced apart in a substantially parallel relationship. Referring to FIG. **11**, the view of the side of the collating machine **10** affords the opportunity to see that there is a stack of documents, previously noted as stack **68**, which is located in the slot receiving space **112**. The leading end of the stack **68** is registered against the vertical surfaces **54** of the disks **56** such that the stack **68** is ready for advancement in the direction **58** when a predetermined engagement of the clutch **62** occurs.

The significant effect of the arrangement previously described is noted in FIG. **10** where it is seen that as sheets move along direction **58**, the leading end of a sheet **116** is guided to engage a bottom side **118** of the stack **68**, which in effect is the latter sheet to be fed from the feeder **50**. In other words, the stack **68** is arranged in reverse order from the original order in the supply stack **60** adjacent the feeder **50**.

It is possible, and will be necessary, to adjust the sheet ramp apparatus **66** such that a trailing end **120** (see FIG. **11**) of the stack **68** has sufficient clearance with respect to the first ramp guide block **70**. The adjustment is provided through the slots **96***a* and **96***b* in the plastic member **88** when screws **98***a* and **98***b* are loosened and tightened appropriately while the sheet stack **68** is in the space **112**. It will be necessary to make the foregoing adjustment whenever the length of the sheets **12** change as well. For example, the standard lengths of 11" and 14" will be accommodated by the apparatus described. The adjustment additionally allows the operator to ensure that the sheets enter the space **112** with a smooth, flowing motion.

Therefore, having briefly described an embodiment of the present invention which enables a machine operator to convert a collating machine from a mode where sheets are collated in one order, to an alternate mode where the sheets may be collated in reverse order, it

will be evident that changes to the drawings or machine described herein will only enhance the present invention which is captured in the spirit and scope of the following claims.

What is claimed is:

1. In a collating machine for stacking sheets of paper being fed seriatim thereto from a singulating feeder in the same order as said sheets appear in said singulating feeder, said collating machine having at least one upper, endless, elastic belt and one lower, endless, elastic belt, each of said belts having an upper and a lower reach, and wherein the lower reach of the upper belt is situated slightly above the upper reach of the lower belt to thereby frictionally engage and transport said sheets of paper, ramp means for lifting a succeeding sheet of paper over and onto a preceding, stopped sheet of paper, said ramp means including a slot for receiving the lower reach of said lower belt, and means for stopping each sheet of paper after said sheet has been lifted by said ramp means, the improvement comprising removable means for stacking said sheets of paper in the reverse order as said sheets appear in said singulating feeder.

2. The improvement set forth in claim 1, wherein said removable reverse order stacking means comprises a first and a second removable ramp guide block, said first block being located adjacent and engaging a portion of the lower reach of the upper belt and the second block being located downstream of the first block and adjacent the upper reach of the lower belt, said second block engaging a portion of said upper reach of the lower belt.

3. The improvement of claim 2, wherein the engaged belt portions are disposed at a predetermined angle with respect to adjacent, non-engaged belt portions.

4. The improvement of claim 3, wherein the predetermined angle is about 135 degrees.

5. The improvement of claim 4, wherein said belts comprise O-ring belts.

* * * * *